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REVIEWS OF RECENT LITERATURE.

WORONIN, Dr. M. *Ueber die Sclerotienkrankheit der Vaccinen-Beeren.* Entwicklungsgeschichte der diese Krankheit verursachenden Sclerotinien, mit 10 Tafeln. Mémoires de l'Académie impériale des Sciences de St. Pétersbourg, VII. Sér., Tome XXXVI, No. 6., Prix: 6 m.

The *Sclerotium diseases of Vaccinium berries* is the title of a new German work by Dr. M. Woronin, which forms one of the memoirs of the Royal Academy of Sciences of St. Petersburg.

Four species of *Sclerotinia*, each attacking a different species of *Vaccinium* are described and illustrated. The species and hosts are (1) *Sclerotinia vaccinii*, Wor. on *V. Vitis Idæa*; (2) *S. oxycocci*, Wor. on *V. oxycoccus*; (3) *S. baccarum*, Schr. on *V. myrtillus*; and (4) *S. megalospora*, Wor. on *V. uliginosum*.

The first named species is described in detail, and the following abstract consists mainly of the author's own summary.

Sclerotium vaccinii is a true parasite, which, however, leaves its host when the Sclerotium is mature, in order to develop itself farther at the expense of the reserve material which it has already appropriated.

The gonidial stage appears in the spring upon leaves and stems of the new shoots of the Cowberry, in the form of a dense, powdery, mold-like coating which emits a strong, pleasant, almond odor. On the stem the fungus usually appears near the end and only on one side, causing the branch to bend so that the fungus comes on the under concave side. The disease proceeds from the stem into the leaves, the bases of which become discolored. In the stem the greatest injury is caused to the cambium layer, which shrivels up and separates from the wood. In the outer bark tissues between the decaying cells is formed a pseudo-parenchymatic cushion from which simple or often dichotomously branched hyphæ break out through the cuticle. These hyphæ are at first beaded and continuous, but later double septa appear at the constrictions. In the center of these septa is cut out a spindle-shaped piece of cellulose, the "disjunctor," which serves the purpose of separating the gonidia at maturity. The ends of the gonidia are at first incurved around these pieces, but when they separate the ends push out, making the gonidia lemon-shaped. The septa form parts of what the author calls the "primary membrane" of the spores, which forms just within the common cell-wall of the original beaded hypha.

The ripe, separated gonidia germinate very differently according to the medium in which they happen to be placed. In perfectly pure water the surface of the gonidium becomes covered with small, round spermatia-like sporidia, which are incapable of germination. In slightly impure water the gonidia put out short hyphæ, which in turn produce

and cut off these small bodies on all sides. In fresh juice pressed from a ripe plum the gonidia grow into branched, many-celled germ tubes, whose cells at once swell up into large spheres and easily anastomose. Finally, in plum and raisin decoction the gonidia produce long, separate, often anastomosing branched hyphæ, which when transferred into pure water again produce the globose sporidia, although they do not do so in the other media.

These gonidia are carried by the wind to the stigmas of the *Vaccinium* flowers, where they germinate. The germ tubes follow the path of the pollen tube, grow down into the ovary, and there develop into a sclerotium-forming mycelium. The cells of the ovary first become filled with a sclerotium-like mass, and the ends of the hyphæ form a palisade-like layer against the ovary wall. Later branches of the hyphæ break through into this wall and form a sclerotium there also. In the mean time some of the central portion has disappeared, so that the complete mature sclerotium is hollow and is composed of two layers, the inner one consisting of the palisade portion of the mass within the ovary cells, and the outer of the pericarp permeated by the fungous mass.

A sclerotium finally develops in every infected berry. Instead of ripening, the berries become dark colored, fall from the plant at the end of the summer, and remain under the snow without any noticeable change through the winter.

In the spring, just after the melting of the snow, primordia are produced somewhat below the rind of the outer layer. These do not always develop farther, more than one of them growing out into chestnut-brown, long-pedicelled, cup fruits only in occasional instances.

The apothecia are bell-shaped at first, later they are plate-like, and finally the edge sometimes turns downward. When the cup is fully formed a shaggy tuft of rhizoids grow out from the base of the stem; they serve the plant not only as a support but as an organ for obtaining nourishment.

The hymenium is composed of paraphyses and asci, the latter being formed from the primordia themselves and the former from outgrowths of the cells of the outer layer of the sclerotium. The paraphyses are fine, simple or dichotomously branched, septate hyphæ, whose upper free ends are slightly club-shaped and surrounded by a brown balsam-like mass. The asci always contain eight ascospores of nearly uniform size, all capable of germination.

Like the gonidia, the ascospores germinate differently according to the substratum in which they are sown. In pure water they also cut off small, globose, spermatia-like sporidia from their sides. In a plum decoction they grow out into long, irregularly formed threads, and swollen spherical protuberances. In a decoction of fresh leaves and young stems of the Cowberry the ascospores put out one or several fine germ tubes, between which and the globose sporidia almost all the intermediate stages can be found.

The ascospores infect the unfolding shoots of the Cowberry in the spring, about the end of May or beginning of June. At the point of contact with the host plant an ascospore puts out one, occasionally two, slender germ tubes, which never penetrate through a stoma but bore between two adjacent epidermal cells or directly through one of these into the host plant.

The germ tubes which are produced by the ascospores seek the fibro-vascular bundles of the host plant, and continue their growth from these bundles as a centre, thus reversing the direction of the fungus so that it grows from the center of the plant toward the periphery. Then appears a most peculiar phenomenon; the fungus exerts an injurious influence on the surrounding tissues of the host plant, killing them first and then using them as food for its further development.

Finally the hyphæ penetrate between the elements of the outer rind, which has been killed by the fungus, and there develop into a large-celled, pseudo-parenchymatic, stroma-like cushion, from which the gonidia chains grow into the air through the ruptured cuticle.

The other three species are dealt with much more briefly, since their general characteristics are much the same as the first one. In the chapters devoted to them the author deals mainly with the features which distinguish them as distinct species and wherein they differ from the first.

He suggests that the second species which attacks the small cranberry, *Vaccinium oxycoccus*, may be the same one that attacks the American cranberry, *V. macrocarpon*, and if this is true says that the matter of routing the disease is an easy one, viz, collecting and burning all the diseased berries in the fall. To one acquainted with the manner and places of growth of American cranberry vines this method might present some practical difficulties.

In conclusion there are a few notes on other forms.

He found the gonidia and a sclerotium like condition of *Acrosporium cerasi*, Rabh., which occurs on the cherry. On *Prunus padus* he found a fungus having the three forms, gonidia, sclerotia, and apothecia, and analogous forms were observed on *Sorbus acuparia*. He is also of the opinion that the well-known *Monilia fructigena* is only the gonidial form of a similar Sclerotium. He has found Sclerotia in the fruit of *Alnus* and *Betula*, and in the latter case has seen a cup fruit grow from the Sclerotia in the spring.

The work is a valuable contribution to our knowledge of the life histories of the *Sclerotiniæ*, and the author's name is sufficient authority for its perfect reliability. The illustrations are particularly fine, and it is a deplorable fact that very few American works can point to similar ones.—EFFIE A. SOUTHWORTH.